

AMENDMENTS TO THE CLAIMS

Claims 1 through 3. (Cancelled)

4. (Previously Amended) A steering assistance controller ~~as claimed in claim 3, wherein~~ for the generation of a compensating torque which assists a vehicle driver in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a steering controller adapted to be connected to the vehicle steering system and operative to derive an estimation of the tendency of the vehicle to oversteer based upon estimates of vehicle yaw rate which are compared with measurements of actual vehicle yaw rate to provide a yaw rate error,

said steering controller includes including a closed loop observer having yaw rate feedback which is arranged such that, when the vehicle starts to oversteer, a non-linear region is entered and the previously existing linear yaw rate estimate diverges from the feedback signal whereby the magnitude of the vehicle yaw rate is greater than the magnitude of the estimated yaw rate, thereby producing a negative yaw rate error which is used to generate a proportional signal indicative of the magnitude of the oversteer, said controller further operative to determine the compensating torque as a function of said proportional signal and to apply the compensation torque to the vehicle steering system to encourage the driver to steer the vehicle back to a non-oversteering condition.

5. (Currently Amended) A steering assistance controller ~~as claimed in claim 1, wherein~~ for the generation of a compensating torque which assists a vehicle driver in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a first lateral acceleration sensor placed in the front axle of the vehicle;
a second lateral acceleration sensor placed in the rear axle of the vehicle; and
a steering controller connected to said first and second lateral acceleration sensors, said steering controller adapted to be connected to the vehicle steering system, said steering controller operative receives to receive a pair of acceleration measurements from [[a]] ~~said first lateral acceleration sensor placed in the front axle~~

~~of the vehicle and [a] second lateral acceleration sensor placed in the rear axle of the vehicle sensors and further wherein said steering controller is adapted to derive [[the]]~~
an estimation of the tendency of the vehicle to oversteer using said measurements from said first and second lateral acceleration sensors, said steering controller further operative to determine the compensating torque as a function of said oversteer estimate and to apply the compensation torque to the vehicle steering system to encourage the driver to steer the vehicle back to a non-oversteering condition.

6. (Currently Amended) [[A]] The steering assistance controller as claimed in claim 5, wherein said steering controller includes a phase detection device and further wherein signals corresponding to the lateral accelerations measured at the front and rear axles are passed through said phase detection device, said phase detection device being operable to determine a phase difference between said measurements from said first and second lateral acceleration sensors with said phase difference being used for calculation of the magnitude of oversteer.

7. (Currently Amended) [[A]] The steering assistance controller as claimed in claim 6, wherein the state of the vehicle is formed from $\lambda = \Theta_{th} - \Theta$;
where λ is the vehicle state, Θ_{th} is a phase lag threshold and Θ is the phase difference between said two lateral acceleration sensors, positive values of λ indicating that the vehicle is in oversteer and λ is proportional to the amount of oversteer present.

8. (Currently Amended) ~~A steering assistance controller as claimed in claim 1,~~
wherein for the generation of a compensating torque which assists a vehicle driver in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a steering controller adapted to be connected to the vehicle steering system, said steering controller [[is]] operative to derive an estimation of the tendency of the vehicle to oversteer based upon a first vehicle model representing an understeering vehicle and a second vehicle model representing an oversteering vehicle which are compared to provide an indication of vehicle oversteer magnitude, said steering

controller further operative to determine the compensating torque as a function of said oversteer estimate and to apply the compensation torque to the vehicle steering system to encourage the driver to steer the vehicle back to a non-oversteering condition.

9. (Previously Amended) A steering assistance controller for the generation of a compensating torque which assists a vehicle driver in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a steering controller adapted to be connected to the vehicle steering system, said controller operative to derive an estimation of the tendency of the vehicle to oversteer based upon two vehicle models representing an understeering and oversteering vehicle which are compared to provide an indication of vehicle oversteer magnitude with a difference in dynamics between said two models being achieved by altering the tire cornering stiffnesses in the models, reducing the front tire stiffness in one model creating an understeering vehicle and reducing the rear tire stiffness in the other model creating an oversteering vehicle, and further including comparators which calculate the error between the measured lateral acceleration and estimated lateral acceleration at that axle for each model, based on:

$$\lambda_f = |A_{fm} - A_{fu}| - |A_{fm} - A_{fo}|;$$
$$\text{and } \lambda_r = |A_{rm} - A_{ru}| - |A_{rm} - A_{ro}|;$$

where:

A_{fu} = Front Axle Lat Acc Estimated from Understeer Model

A_{ru} = Rear Axle Lat Acc Estimated from Understeer Model

A_{fo} = Front Axle Lat Acc Estimated from Oversteer Model

A_{ro} = Rear Axle Lat Acc Estimated from Oversteer Model

A_{fm} = Front Axle Lat Acc Measured from a Sensor

A_{rm} = Rear Axle Lat Acc Measured from a Sensor;

this giving two values for the vehicle state which are added together to produce an overall vehicle stability factor λ , as given by the relationship:

$$\lambda = \lambda_f + \lambda_r$$

where positive values of which are indicative of vehicle oversteer, said controller

further operative to encourage the driver to steer the vehicle back to a non-oversteering condition through the application of the compensating torque.

10. (Currently Amended) A steering assistance controller ~~as claimed in claim 1, wherein said~~ for the generation of a compensating torque which assists a vehicle driver in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a steering controller [[is]] operative to derive an estimation of the tendency of the vehicle to oversteer based upon a percentage of the VSC threshold at which brake intervention in oversteer occurs such that the steering assistance controller is actuated before the VSC, said steering controller further operative to determine the compensating torque as a function of said oversteer estimate and to apply the compensation torque to the vehicle steering system to encourage the driver to steer the vehicle back to a non-oversteering condition.

11. (Cancelled)

12. (Cancelled)

13. (Currently Amended) A steering assistance controller for the generation of a compensating torque which assists a vehicle driver in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a steering controller adapted to be connected to the vehicle steering system, said controller operative ~~detection~~ to detect that the vehicle is in an oversteer condition and to control the steering by applying a pulse input that generates a "nudge" to indicate to the driver the correct time and direction to apply steering control, said steering controller also including a nudge controller that generates a signal if the vehicle yaw rate error is detected to be greater than a predetermined threshold, this signal being used to trigger a latch, the output of which sets an integrator ramping, said signal also being used to generate a torque demand signal which is fed to the vehicle steering system to initiate the start of said "nudge", saturation of the integrator resetting the

latch and ending said "nudge".

14. (Cancelled)

15. (Currently Amended) A steering assistance controller ~~as claimed in claim 14, wherein~~ for the generation of a compensating torque which assists a vehicle driver in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a steering controller adapted to be connected to the vehicle steering system, said steering controller includes including first and second PD controllers with said first PD controller implemented on ~~[[the]]~~ a vehicle yaw rate error to generate a steering rate demand which is compared with a scaled version of the steering wheel velocity to produce an error signal, said second PD controller being responsive to said error signal to generate a signal which attempts to move the steering wheel with a desired direction and velocity to correct the oversteer.

16. (Currently Amended) A steering assistance controller ~~as claimed in claim 1, wherein said~~ for the generation of a compensating torque which assists a vehicle driver in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a steering controller includes including an activation controller which is operative to fade said steering controller in when said activation controller has determined that the oversteer has exceeded ~~limits~~ a predetermined threshold and to fade said steering controller out ~~[[once]]~~ when said activation controller has determined that the oversteer has returned to ~~an acceptable~~ a value that is less than said predetermined threshold, said steering controller further operative to determine the compensating torque as a function of vehicle state information and to apply the compensation torque to the vehicle steering system to encourage the driver to steer the vehicle back to a non-oversteering condition.

17. (Currently Amended) A steering assistance controller ~~as claimed in claim 16, wherein~~ for the generation of a compensating torque which assists a vehicle driver

in overcoming the tendency of a vehicle to oversteer, the controller comprising:

a steering controller adapted to be connected to the vehicle steering system, said activation controller comprises including activation logic which is adapted to control the point at which said steering controller starts, deactivation logic which detects conditions for deactivation of said steering controller, and a fade control which fades the inputs and outputs from said steering controller in and out as said steering controller is switched on and off, said steering controller operative to determine the compensating torque as a function of vehicle state information and to apply the compensation torque to the vehicle steering system to encourage the driver to steer the vehicle back to a non-oversteering condition.

18. (Currently Amended) [[A]] The steering assistance controller as claimed in claim 17, wherein said activation logic comprises a threshold oversteer value and a latch arranged such that when the oversteer signal exceeds the threshold, the latch is set and remains set until a deactivation flag triggers a reset.

19. (Currently Amended) [[A]] The steering assistance controller as claimed in claim 17 wherein said activation controller comprises an integrator which, upon detection of an activation flag being high, is operative to ramp up to allow the torque generated by the steering controller to be gradually added to the steering system, but which, on detection of the activation flag becoming low, ramps down to gradually remove the torque generated by the steering controller from the steering system.